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Lemma 20.3, ΠΑΦ042 (ZS06/07)

$$F_{f,m}(t) = \sum_{n=-m}^m c_n e^{inx} = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x+r) D_m(r) dr ;$$

$$\text{see } D_m(r) = \frac{\sin\left(m + \frac{1}{2}\right)r}{2 \sin \frac{r}{2}}$$

(Dirichlet kernel)

substitution $r \rightarrow -r$ and use $D_m(r) = D_m(-r)$

$$\text{derive: } = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x-r) \cdot D_m(r) dr = \frac{1}{\pi} (f * D_m)(x).$$